Villasenor-Rodriguez, Yesenia

From: VanGyseghem, Bob [bvangyseghem@geneva.il.us]
Sent: Tuesday, October 26, 2010 2:45 PM
To: Dennis Duffield; Villasenor-Rodriguez, Yesenia
Subject: Written Testimony
Attachments: Hearing Letter.pdf

Dennis and Yesenia,

Attached is my written testimony. Could you please enter this into the record as I will be unable to attend.

Thanks

Bob Van Gyseghem
Superintendent of Water and Wastewater
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Prepared Written Testimony of Bob Van Gyseghem
Representing the City of Geneva

October 27, 2010

My name is Bob Van Gyseghem. I am the Superintendent of Water and Wastewater for the City of Geneva. I received a Bachelor's of Science Degree in Sociology from Northern Illinois University, DeKalb, IL in December of 1989. I am a registered Class A Water Supply Operator through the IEPA.

In previous testimonials I have submitted costs which represent a significant burden that would be placed on the rate payers of the City of Geneva to comply with the proposed rulemaking by the Illinois Emergency Management Agency. Due to the limited time given to prepare, costs related to implementing a treatment process at the Water Treatment Facility to capture radium residuals as requested by IEMA were not completed. A significant amount of engineering would be required and a consultant would need to be hired. This was not budgeted for and therefore could not be completed. While the previously submitted costs have not changed, water and sewer revenues are not meeting projections even with a 3% rate increase enacted May 1, 2010. Current revenue figures are down $219,000.00 or 7% lower than projections. Costs to comply with the proposed rulemaking would further burden a reduced budget with declining revenues.

I ask that IEMA work with stakeholders and enact a rulemaking process which is protective of human health and economically feasible.

Sincerely,

Bob Van Gyseghem
Superintendent of Water and Wastewater
City of Geneva, IL 60134

Yesenia Villasenor-Rodriguez's Testimony for 10.27.10 Public Hearing

My name is Yesenia Villasenor-Rodriguez and I am appearing on behalf of the City of Joliet and other stakeholders, as their attorney with the law firm of Drinker Biddle & Reath LLP. Joliet is here today to provide testimony in support of what it believes to be an acceptable alternative to the 0.4 pCi/.g limitation that IEMA has proposed as part of the pending rulemaking affecting 32 Ill. Adm. Code 330.40 "Licensing of Radioactive Materials." Specifically, Joliet would like to make clear that this proposed rule is not an exemption as such has been categorized by IEMA in its second-notice filing responses before the Joint Committee on Administrative Rules (JCAR). Rather, the proposed rulemaking is indeed a new regulation which is unnecessarily restrictive and results in significant economic implications for the City of Joliet and other similarly situated communities.

Indeed, Joliet strongly believes that the record contains sufficient information to support that this rulemaking is arbitrary, capricious, and an abuse of IEMA's discretionary rulemaking authority.

Throughout this rulemaking, Joliet has consistently held its position that a 1.0 pCi/g limitation is protective of human health and the environment. In support of this position, Joliet has submitted a substantial amount of information to IEMA. However, a recent review of the evidence in the record including IEMA's responses to public comments, supports that a higher limitation of at least 2.0 pCi/g is also an acceptable alternative to what IEMA has proposed while also being protective of human health and the environment.

Joliet has worked with three health physicists in order to ensure that what it has requested is indeed protective of human health and the environment. This rulemaking is very complex and therefore, requires careful consideration by experts in the field of health physics. Joliet like IEMA is a governmental body and is concerned with protecting the public health & safety and environment of its citizens and/or of any consequences related to its activities. Consequently, Joliet and IEMA share a similar goal. However, Joliet's team has the actual expertise and experience because it has been operating a land application program for over 20 years. This program is something new for IEMA and, therefore, although IEMA is the delegated authority under Illinois law with respect to radiation safety, Joliet respectfully requests that it be allowed to share in a open manner and work with IEMA to establish what it believes to be an acceptable rulemaking based on its past experiences and significant involvement with the pending rulemaking and affected communities.

Before Joliet shares what it believes to be an acceptable rule promulgation, Joliet must first address IEMA's responses to the public comments as was filed with the Joint Committee on Administrative Rules ("JCAR") and the public health and safety considerations.

Unfortunately, it was not until IEMA filed its responses to the public comments as part of its second notice filing with JCAR, that Joliet received comments from IEMA regarding the data/testimony it had submitted in this proceeding. Because this occurred after the close of the public record, Joliet was unable to provide any comments to IEMA's responses. However, now as a result of JCAR's directive that IEMA conduct an additional meeting with the stakeholders, Joliet is afforded this opportunity to respond thereto. Particularly, Joliet requested that two of its health physicists conduct a review of the technical responses that IEMA provided to JCAR.

Up until this point and through the date of this hearing, Joliet is still without knowledge as to what concerns IEMA has in promulgating a regulation with the 1.0 pCi/g. or greater. Notwithstanding the above, in reviewing the record, Joliet's experts determined that there were some mistakes committed on the part of IEMA, which Joliet believes to be the reason for why it has proposed an unnecessary and overly burdensome rule.

Specifically, in reviewing IEMA's responses to the public comments, Joliet noted that IEMA misconstrued and took many statements in its responses out of context from the original sources. Joliet is not here to argue whether this was a deliberate or inadvertent act on the part of IEMA but rather simply respond. In fact, on October 25, 2010, Joliet submitted pre-filed questions to IEMA with specific references to where it noted that IEMA misconstrued the information it provided to IEMA.

Before proceeding any further, Joliet acknowledges that IEMA is the "designated" expert authority in radiation. However, with all due respect, the discrepancies found by Joliet's health physicist experts, point to the fact that the individuals who prepared the response to the public comments and/or that are directly involved in this particular rulemaking perhaps are not fully equipped with the specialized expertise needed to make an appropriate determination as to what is or is not an acceptable rulemaking.

Joliet acknowledges that this is strong statement and that is why, it (1) has filed pre-filed questions regarding the particulars to give IEMA an opportunity to address these fatal technical errors; and (2) why it has brought Mr. Eli Port and Dr. Kenneth Mossman, two expert health physicists to testify today. Let the record reflect that Mr. Port has previously testified at the public hearings held in September of 2009 and April 2010.

Joliet was hopeful that IEMA would have conducted true stakeholders meeting in the past, whereby, IEMA and the regulated community could discuss what the facts and issues are and thus, narrow the points for which there may be differences with respect to any technical issues. Although we have not had "stakeholders meetings" we are grateful to have this additional meeting. In brining Mr. Port and Dr. Mossman, we are hopeful that today we can resolve some of those issues because this would be the appropriate forum and not, before JCAR since they are not the delegated experts for radiation protection in Illinois.

Joliet is more than willing to work with IEMA to bring resolution to this rulemaking and to adopt a land application program that is economically feasible while also being protective of human health and the environment. As such, Joliet is proposing that IEMA adopt a rulemaking of 2.0 but at least 1.0 pCi/g or greater. Dr. Mossman and Mr. Port will present information today as to why this rulemaking is protective of human health and the environment. While Mr. Duffield and Mr. Eggen will present information concerning costs, alternate disposal methods, and coordination with stakeholders.

Testimony before the Illinois Emergency Management Agency

Wednesday, October 27, 2010

Re: Licensing of Radioactive Materials, 33 Ill. Reg. 12061, Proposed Rulemaking

My name is Dennis Priewe of the Rock River Water Reclamation District (District). The District is located at 3501 Kishwaukee Street, in Rockford. I am employed in the Plant Operations Department and supervise the USEPA approved Industrial Pretreatment Program.

The District is a regional sanitary district that serves the cities of Rockford, Love Park, Machesney Park, Cherry Valley and Roscoe in north central Illinois. The District receives an average daily flow of about 30 million gallons of wastewater that is treated at its central plant located in Rockford. The treatment plant solids are treated with anaerobic digestion and dewatered by centrifuge. The dewatered solids are stored on site until they can be land applied on area agricultural fields.

In addition to serving these communities, the District receives the backwash water from the municipal water treatment plants for Rockford and Loves Park. These municipalities are in various stages of completion on their plant upgrades. The upgrades include treatment of the raw water at certain wells for the removal of radium with the subsequent filter backwash being discharged to the District sewer collection system. The District has been receiving the treated backwash water from the Loves Park water department for the last couple of years, while the Rockford water department has just gone on line in 2010 with two wells that have radium treatment. A third radium treatment well is scheduled to go on line in 2011.

The District has been monitoring and collecting data on radium since we first started to receive the radium bearing residuals in the Loves Park backwashes. The purpose of this monitoring is to determine whether there will be any adverse impact on the District's Biosolids application program. The District has conducted sampling of the treated water as it is discharged during the backwash cycle from the water treatment plants that remove radium. In addition, we have monitored radium levels in the wastewater as it passes through all of the treatment components at the plant. Although the Rockford water department has just recently begun to discharge radium bearing backwash residuals to the District, we have seen a nearly 50% increase of radium in the Biosolids. Although the levels that are currently found in our Biosolids do not greatly impact the number of allowable land applications under the proposed rate, the District does not yet know the full impact of radium bearing backwash residuals, as we have not yet started to receive the maximum daily loadings of radium bearing residuals until all the respective water departments complete their water treatment plant upgrades.

It is our understanding that several communities that may be impacted have not yet started to collect data to evaluate the impact of these proposed standards. Even with the large amount of data that the District has compiled, we do not know the final implication. The District feels that this rulemaking process should continue involving serious discussions with all the stakeholders while additional communities implement their water treatment programs. It is our opinion that there is not enough information from all of the potential stakeholders to make an informed decision on the financial and public health impacts of this rule. The District is concerned that this rulemaking precedes the collection of valid scientific data in order to address the concerns that were given by the Joint Commission on Administrative Rules.

Thank you for the opportunity to speak today.

Public Hearing
Licensing of Radioactive Material
32 Ill. Adm. Code 330.40
Wednesday, October 27, 2010

rad

My name is Abdul Khalique. I am a Radiation Chemist at the Metropolitan Water Reclamation District of Greater Chicago (District) and have been working for the District for the last 15 years. I have a Ph.D. in Chemistry from the University of Birmingham, U.K.

I would like to present data on a study conducted by us to show that land application of biosolids produced at the District has had minimal impact on soil and corn crop quality and does not appear to increase risk of radiation exposure to the public and cause any health and safety concern.

The Metropolitan Water Reclamation District of Greater Chicago (District) produces 190,000 dry tons of biosolids annually and uses them to fertilize turf and crops. The District owns a large tract of land in Fulton County, Illinois, (6,122 ha). This site has been used since 1971 to recycle biosolids for the purpose of reclaiming mine soil and to fertilize agricultural crops. During most of the history of this project, the District has maintained a set of experimental plots that have received long-term, high rate, continuous biosolids applications on mine soil. The Fulton County Corn Fertility Plots were established to assess improvements in soil fertility and uptake of trace metals into corn resulting from long term applications of biosolids to reclaim strip mined soil. These Plots have received annual biosolids applications at the rate of 16.8, 33.6, and 67.2 ton/ha to four replicated plots from 1973 to the present along with commercial fertilizer, which was applied annually to control plots. The plots have been cropped continuously in corn. Soil, corn grain and corn stover (above ground matter remaining after grain harvest) from this site were sampled in 2000 for this study.

The purpose of this study was to evaluate long term effects of high rate biosolids applications on soil fertility and transfer of trace metals to corn. Samples from these plots were used to evaluate the effect of long-term application of biosolids on the radioactive materials concentration in biosolids-amended soil, and uptake of radioactivity into corn grain and stover.

It was concluded from this study that the long-term high rate biosolids applications to strip-mine soil at the District's Fulton County Site did not significantly effect the concentrations of gross alpha or gross beta radioactivity and gamma-emitting radionuclides in the biosolids-amended soil or in corn tissues, and does not appear to increase the risk of radiation exposure to the public and cause any health and safety concern.

This study has been published in a paper entitled "Assessment of Radioactivity in Chicago Biosolids and its Transfer to Soil and Crops from long Term Application". This paper was published in the inaugural issue of Water Practice (Vol. 1, No.1, April 2007), a peer-reviewed journal published by the Water Environment Federation.

I am submitting this paper for your information.

Assessment of Radioactivity in Chicago Biosolids and its Transfer to Soil and Crops from Long Term Application

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ABSTRACT

The Metropolitan Water Reclamation District of Greater Chicago (District) produces 190,000 dry tons of biosolids annually and uses them to fertilize turf and crops. The District has maintained a continuous corn fertility study, with replicated plots receiving 0 (commercial fertilizer), 16.8, 33.6, and 67.2 Mg biosolids ha^{-1} annually, since 1973. Samples from 2000 were used to evaluate the effect of long-term biosolids applications on the radioactivity concentration in soil, and the uptake of radioactivity into corn grain and stover. There were no significant differences ($p<0.05$) in radionuclides concentrations in soil, corn grain and stover among the treatment plots. Of the 27 radionuclides studied, only potassium-40 (grain and stover) and radium-226 (grain) were detected in plant tissue. Long-term annual applications of biosolids did not increase radioactive materials concentration in soil or increase uptake of radioactivity by corn in biosolids-amended soil, compared to fertilized, plots in this study.

KEYWORDS: Biosolids, radioactivity, uptake, land application, corn, soil radionuclide, alpha emitter, beta emitter, photon emitter.

INTRODUCTION

The Metropolitan Water Reclamation District of Greater Chicago is located within the boundaries of Cook County, Illinois. It is one of the largest municipal wastewater treatment agencies in the nation and operates seven water reclamation plants (WRPs). It serves an area of 0.226 Mha including the City of Chicago and 125 suburban communities with a combined population of 5.1 million people. In addition, a waste load equivalent of 4.9 million people is contributed within the District's service area by industrial and commercial sources. On the average, the District treats 5.68 million cubic meters per day of wastewater at its seven WRPs.

Radioactivity in the sewerage system may enter from a variety of sources including industries, hospitals, research organizations, and licensed radioactive material users. Naturally occurring radionuclides and those in atmospheric fallout also enter the sanitary sewerage system from groundwater and through stormwater runoff. The purpose of wastewater treatment is to remove pollutants from raw sewage to ensure adequate effluent quality and reduce its adverse impact on the receiving surface waters. The low concentrations of radioactive materials from natural and man-made sources discharged to the sanitary sewerage system may become concentrated in biosolids during wastewater treatment and sludge processing.

Elevated levels of radioactive materials in sewage sludge and ash could pose a threat to the environment and to the health of the general public. The POTW workers, farmers and other members of the public who use biosolids products containing radioactive materials as a fertilizer or soil conditioner could be exposed to ionizing radiation. The most likely route of radiation exposure is through inhalation, ingestion, and direct exposure. Alpha radiation consists of energetic positively charged particles ejected spontaneously from nuclei of some radioactive elements. They are identical to a helium nucleus (two protons and two neutrons). Because of their large mass and electrical charge compared to other subatomic particles, they travel a short distance and lose energy rapidly. They cannot penetrate the surface layer of human skin and can be stopped by a sheet of paper. As a result they do not pose a serious external hazard but can be harmful if inhaled or ingested. Beta particles, which are high energy electrons or positrons, are more penetrating than alpha particles and skin damage can result from external exposure. Inhalation of alpha- or beta-emitting radioactive materials is a concern because radioactive material taken into the body results in radiation dose to internal organs and tissues. These forms of ionizing radiation are damaging to internal organs and tissues. Inhalation of radioactively contaminated dust blown from drying or land application of biosolids can occur. Ingestion of alpha- or beta-emitting radioactive materials may occur either through inadvertent hand to mouth transfer of biosolids amended soil or when food is grown on an area where biosolids have been applied to the land as fertilizer or soil conditioner. Ingestion could also occur when radioactive materials migrate into ground water or surface waters which are used as a drinking water source. Radioactive materials that emit gamma radiation are also of concern. Gamma rays are commonly called photons and have no mass or electrical charge. Gamma rays are more penetrating than alpha and beta particles, pose an external radiation exposure hazard, and can cause biological damage.

The National Association of Clean Water Agencies, which was formerly named the Association of Metropolitan Sewerage Agencies (AMSA), conducted a national survey of radiation levels in sewage sludge in 1995. The survey results were published in May 1999 in the National Biosolids Partnership Report No.1 (NBP 1999). The survey included eighty biosolids (sludge, cake, compost), seven sludge incinerator ash and one skimmings sample from 55 POTWs located in 17 states. Nine radionuclides, namely, Ac-228, Be-7, Bi-214, I-131, K-40, Tl-208, Pb-212, Pb-214, and Ra-226 were found in more than sixty samples. In 1995 the Nuclear Regulatory Commission (NRC) and EPA formed the Interagency Steering Committee on Radiation Standard (ISCORS) to resolve and coordinate regulatory issues associated with radioactive material in sewage sludge. The ISCORS conducted a survey from 1998 to 2000 to collect information on radioactivity in sewage sludge and ash from POTWs around the country (ISCORS 2003). The survey included 311 sewage sludge and 35 ash samples from 313 POTWs. Eight radionuclides, namely Be-7, Bi-214, I-131, K-40, Pb-212, Pb-214, Ra-226 and Ra-228 were found in more than 200 sewage sludge samples. The survey indicated that, at most POTWs, radiation exposure to workers or the general public, including farmland application of biosolids from growing food crops, is very low and is not likely to be a concern. The survey results represented only a single sampling event at the 313 POTWs targeted as potential sites to have elevated levels of radionuclides an do not necessarily represent typical levels in POTWs across the country.

The District routinely monitors the quality of its raw sewage, final effluent, sludge, and biosolids. The annual results are published in a report entitled "Radiological Monitoring of Raw Sewage, Final Effluent, Sludge, and Biosolids of the Metropolitan Water Reclamation District of Greater Chicago – Annual Report" (Khalique 2005). The District produces approximately 190,000 dry tons of biosolids each year. These biosolids are rich in plant nutrients and organic matter and are beneficially used through land application. The beneficial uses include application to turf at parks, golf courses and athletic fields; application to agricultural lands to fertilize crops; application to strip-mined or other disturbed soils for reclamation, which may result in crop production; and use at landfills as a soil conditioner or soil substitute in the final cover.

Radioactivity in soil is a potential source of contamination for food and forage, as well as potential source of contamination if homes are built on land that was amended with sewage sludge for many years. Radionuclides may accumulate in plants either from atmospheric deposition on the leaves and shoots or through uptake by the roots from the soil. Plants contaminated with radioactivity pose a risk to human health either through direct ingestion of crops, or indirectly from the ingestion of milk from animals raised on contaminated forage. The District owns a large tract of land in Fulton County, Illinois (6,122 ha). This site has been used since 1971 to recycle biosolids for the purpose of reclaiming mine soil and to fertilize agricultural crops. During most of the history of this project, the District has maintained a set of experimental plots that have received long-term, high rate, continuous biosolids applications on mine soil. The Fulton County Corn Fertility Plots were established to assess improvements in soil fertility and uptake of trace elements into corn resulting from long term applications of biosolids to reclaim strip mined soil. These Fulton County Corn Fertility Plots have received annual biosolids applications at the rates of 16.8, 33.6, and 67.2 Mg ha^{-1} to four replicated plots from 1973 to the present along with commercial fertilizer, which was applied annually to control plots. The plots have been cropped continuously in corn. Soils, corn

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grain, and corn stover (above ground matter remaining after grain harvest) from this site were sampled in 2000 for this study. The study reported in this paper utilized the Fulton County Corn Fertility Plots to evaluate the effects of long-term high rate applications of biosolids on radionuclides concentration in soil and the uptake of radioactivity by corn harvested from biosolids-amended soils.

The purpose of this study is to evaluate long term effects of high rate biosolids applications on soil fertility and transfer of trace elements to corn. In 2000, samples from these plots were used to evaluate the effect of long-term applications of biosolids on the radioactive materials concentration in biosolids-amended soil, and the uptake of radioactivity into corn grain and stover.

METHODOLOGY

Plot Description and Sample Collection.
The Fulton County Corn Fertility Plot Experiment is established on calcareous mine spoil soil (silty clay loam, pH 7.8, calcium carbonate, equivalent of 32 g kg^{-1}). The experimental design is a random complete block with four treatment plots contained in each of four replicated blocks. Each plot is 12.2 m long and 4.6 m wide. The treatments consist of control (no biosolids, fertilized with 336-224-112 kg ha^{-1} of N-P-K annually), and biosolids-amended plots receiving annual application rates of 16.8 Mg ha^{-1} (quarter-maximum), 33.6 Mg ha^{-1} (half-maximum), and 67.2 Mg ha^{-1} (maximum). The biosolids plots also receive 112 kg ha^{-1} of potassium fertilizer annually. The biosolids treatments and the fertilizers are incorporated in the soil at 15 cm deep by rototilling. The loading rates of plant available N, total P, and K associated with the biosolids treatments varied annually due to variations in concentrations of these nutrients in the biosolids applied. During the 1973 to 2000 period, mean annual rates of 1,200 kg plant available N, 1,650 kg P, and 200 kg K per hectare were applied to the maximum plots, and one-half and one-quarter of these rates in the half-maximum and quarter-maximum plots, respectively. The cumulative biosolids loadings that were received by the quarter-maximum, half-maximum, and maximum amended plots from 1973 through 2000 were 455, 909, and 1,817 Mg ha^{-1}, respectively. Additional detailed information on these plots is reported by Pietz et al. (1983).

Biosolids applied to the plots were anaerobically digested primary and waste activated sludge generated at the District's Calumet and Stickney WRPs. At the beginning of the Fulton County Corn Fertility Plot Experiment, these biosolids were conveyed to Fulton County in liquid form and were held in large basins for application to the District's 6300 ha dedicated land reclamation site. Biosolids were initially applied to the plots as a liquid and then as a dewatered cake originating from the basins. Because the Fulton County Corn Fertility Plots were not originally intended to study radioactivity, the biosolids that were applied to them were not analyzed for radioactive materials. This is discussed further in the Results and Discussion section of the paper.

The Fulton County Corn Fertility Plots were established on calcareous strip-mine soil. Soil samples were collected in each plot in 2000 by compositing 12 cores at the 0 to 15-cm depth to produce a single soil sample from each replicate plot. Corn grain and stover were harvested from 10.7 m strips within the middle two rows of each plot. A representative sample of each was collected from the harvested matter in each plot. In 2000, the mean yield of corn stover was 1, 2.2, 2.0 and 2.5 Mg ha^{-1} for the control, quarter maximum, half maximum, and maximum amended plots, respectively. The mean yield of corn grain was 2383, 1442, 2258, and 4641 kg ha^{-1}, for the control, quarter maximum, half maximum, and maximum amended plots, respectively.

Sample Preparation
Corn grain and stover samples were washed and dried at 65° C for 48 hours. Samples were then ground in a Wiley mill and sieved through a 20-mesh stainless steel screen. Soil samples were air-dried and ground to pass a 2-mm sieve (Pietz et al. 1983).

Gross Alpha and Beta Radioactivity
Gross alpha and beta radioactivity concentrations in the samples were determined using method number 7110 B of the Standards Methods for the Examination of Water and Wastewater (Standard Methods, 20th Edition, 1998).

A thoroughly mixed sample of soil, corn grain, or corn stover was transferred to a tared evaporating dish. The sample was dried in an oven to constant weight at 103° C. The difference in weight of the dried sample over the empty dish represents the total sample dry weight. The dried sample was then transferred to a cool muffle furnace. The temperature of the furnace was raised gradually over a period of three hours to 550° C, and the sample was incinerated overnight at this temperature. The residue in the dish represents the fixed solids. The fixed solids were ground to a fine powder. A weighed portion of the fine powder (80 to 100 mg) was transferred to a tared stainless planchet. The residue was distributed to a uniform thickness and spread with a few drops of 0.5% (w v^{-1}) Lucite solution in acetone. It was then dried to constant weight at 103° C and counted for gross alpha and gross beta radioactivity on a Tennelec LB5100 Gas Proportional Counter. A National Institute of Standards and Technology (NIST) traceable thorium-230 standard for gross alpha and cesium-137 standard for gross beta radioactivity were used for efficiency calibration of gas proportional counters.

Gamma Radioactivity

The dried soil, corn grain, or corn stover sample was packed in a tared 85-g canister, and then weighed and sealed with a vinyl electrical tape to avoid the loss of the gaseous progeny of uranium and thorium. The sample was stored for at least 30 days for radon-radium to reach equilibrium before counting. The sample was analyzed by gamma spectroscopy using method number 7120 B of the Standard Method for the Examination of Water and Wastewater (Standard Methods, 20th Edition, 1998). A list of radionuclides monitored is given in Table 1.

Table 1: List of Radionuclides Monitored.

Beryllium-7	Sodium-22	Potassium-40	Manganese-54
Cobalt-57	Cobalt-60	Zinc-65	Niobium-94
Ruthenium-106	Silver-108m	Silver-110m	Antimony-125
Cesium-134	Cesium-137	Cerium-144	Europium-152
Gadolinium-153	Europium-154	Europium-155	Bismuth-207
Bismuth-212	Lead-212	Bismuth-214	Lead-214
Radium-226	Actinium-228	Protactinium-231	

The gamma spectroscopy system was equipped with a p-type coaxial high purity germanium detector with a relative efficiency of 25% and a resolution of 1.8 keV full width at half maximum at 1,332.5 keV gamma transition of Co-60. The spectroscopy system was also equipped with a Ginie-2000 spectroscopy software package from Canberra Industries. The detector was shielded by a 10-cm thick low background virgin lead cylindrical shield with a fixed bottom, and a moving cover and graded lining of 0.5 mm cadmium and 1.6 mm copper to reduce gamma ray background.

The gamma spectrometer was calibrated with a NIST traceable 9 radionuclide mixed gamma standard from North American Scientific, Inc., density 1.07 g cm^{-3}, and packed in an 85-g canister with an energy range of 88 keV to 1,836 keV. The energy and efficiency calibration of the system was verified before each use. The radium-226 radioactivity concentration was evaluated from 186.2 keV photopeak, cesium-137 from 661.6 keV photopeak, bismuth-212 from 727.2 keV photopeak, lead-212 from 238.6 and 300.1 keV photopeaks, bismuth-214 from 609.3 and 1,120.3 keV photopeaks, and lead-214 from 295.2 and 351.9 keV photopeaks. The activity of potassium-40 was derived from 1,460.8 keV photopeak, and actinium-228 from 338.3, 911.6, and 969.1 keV photopeaks.

Statistical Analysis
Statistical analysis was performed using the analysis of variance (ANOVA) to test for the significant differences (Walpole and Myers 1989).

RESULTS AND DISCUSSION

Gross Alpha and Gross Beta Radioactivity in Raw Sewage, Final Effluent, and Biosolids from the District's Stickney and Calumet WRPs
The District treats wastewater at its seven WRPs to remove pollutants to ensure adequate effluent quality and reduce its adverse impact on receiving surface water. Many of the contaminants removed by the wastewater treatment process are concentrated in sludge and biosolids. The District monitors the quality of the raw sewage, final effluent, sludge, and biosolids for radioactive contaminants as a part of its overall monitoring program at its WRPs. The District has been monitoring gross alpha and beta radioactivity in biosolids since 1996. The ten-year (from 1996 to 2005) average concentration of gross alpha and gross beta radioactivity in raw sewage, effluent, and biosolids at the Calumet and Stickney WRPs is given in Table 2. The data is used to determine the need for nuclide-specific analysis. If gross alpha and gross beta radioactivity concentration is 185 Bq kg^{-1} or greater then gamma spectroscopy is also performed to determine the presence of specific gamma-emitting radionuclides.

Table 2. The Ten-Year Average Concentration of Gross Alpha and Gross Beta Radio-activity in Raw Sewage, Effluent, and Biosolids at the Calumet and Stickney WRP.

Sample Type	Location			
	Calumet WRP		Stickney WRP	
	Gross Alpha	Gross Beta	Gross Alpha	Gross Beta
Raw Sewage (Bq L^{-1})	<0.17	0.60 ± 0.18	<0.19	0.76 ± 0.21
Effluent (Bq L^{-1})	<0.15	0.38 ± 0.08	<0.14	0.34 ± 0.06
Biosolids (Bq kg^{-1})	359 ± 133	855 ± 52	326 ± 118	918 ± 59

The data show that the mean gross alpha radioactivity concentration in the raw sewage of the Calumet WRP is <0.17 Bq L^{-1} and in the effluent it is <0.15 Bq L^{-1}. The mean gross alpha radioactivity concentration in the raw sewage of the Stickney WRP is <0.19 Bq L^{-1} and in the effluent it is <0.14 Bq L^{-1}.

The data show that the mean gross beta radioactivity concentration in the effluent is lower than the radioactivity concentration in the raw sewage. The mean gross beta radioactivity concentration in the raw sewage of Calumet WRP is 0.60 Bq L^{-1} and in the effluent it is 0.38 Bq L^{-1}. The mean gross beta radioactivity concentration in the raw sewage of Stickney WRP is 0.76 Bq L^{-1} and in the effluent it is 0.34 Bq L^{-1}. The precision of the measured radioactivity concentration in raw sewage, effluent and biosolids is determined by estimating the standard deviations as shown in Table 2. The radioactive materials removed by the wastewater treatment process are concentrated in biosolids.

The mean gross alpha radioactivity concentration in the biosolids of the Calumet WRP is 359 Bq kg^{-1} dry weight (DW) and mean gross beta radioactivity concentration is 855 Bq kg^{-1} DW. The mean gross alpha radioactivity concentration in Stickney WRP biosolids is 326 Bq kg^{-1} DW and the mean gross beta radioactivity concentration is 918 Bq kg^{-1} DW.

The biosolids applied to the Fulton County Corn Fertility Plots from 1973 through 2000 originated from both the Stickney and Calumet WRPs. During the 1970s and 1980s, biosolids from these WRPs were commingled in large liquid biosolids holding basins prior to application to the plots and it is not possible to ascertain the exact proportion that originated from Calumet and Stickney. Since the Fulton County Corn Fertility Plot Experiment was not originally intended to assess radioactivity, the biosolids that were applied to the plots were not analyzed for radioactive materials. Therefore data from the District's radioactivity monitoring program, which are reported in Table 2 are the only data available on gross alpha and beta radioactivity concentrations in District biosolids and are used in this paper to provide an approximation of the concentration of this radioactivity in the biosolids that were actually applied to the Fulton County Corn Fertility Plots.

Gamma-Emitting Radionuclides in Biosolids from the District's Stickney and Calumet WRPs

The District has also been monitoring the gamma-emitting radionuclides in biosolids at its WRPs since 1999. Out of 27 radionuclides monitored, only nine have been detected at measurable concentrations. The seven-year (from 1999 to 2005) average concentration of gamma-emitting radionuclides detected in biosolids at the Calumet and Stickney WRPs is given in Table 3. The data from ISCORS and AMSA study on the concentration of radionuclides in sludge including minimum, median and maximum concentration for each radionuclide is also included in Table 3

Table 3. The Seven-Year Average Concentrations of Gamma-Emitting Radionuclides in Calumet and Stickney WRP Biosolids and Radionuclides Concentration in Sludge from the ISCORS and AMSA Study.

Radionuclides	Calumet WRP (Bq kg^{-1} DW)	Stickney WRP (Bq kg^{-1} DW)	ISCORS (Bq kg^{-1} DW)			AMSA (Bq kg^{-1} DW)		
	Mean ± SD	Mean ± SD	Min	Med	Max	Min	Med	Max
Potassium-40	307 ± 18	387 ± 30	ND	148	962	ND	166	2250
Radium-226	167 ± 16	126 ± 20	ND	74	1739	ND	64	4370
Cesium-137	2.6 ± 0.7	3.0 ± 0.7	ND	ND	133	ND	ND	14
Beryllium-7	229 ± 85	366 ± 78	ND	44	814	ND	57	1851
Bismuth-212	15 ± 0.0	12.6 ± 3.7	ND	ND	481	ND	17	425
Lead-212	18 ± 3.7	18 ± 3.8	ND	16	555	3	18	270
Bismuth-214	52 ± 3.7	40 ± 7.4	ND	11	592	4	24	1447
Lead-214	59 ± 11	43 ± 3.7	ND	12	629	5	26	1720
Actnium-228	44 ± 7.4	33 ± 11	NA	NA	NA	ND	48	1890

SD = Standard Deviation
Min = Minimum
Med = Median
Max = Maximum
ND = Not detected
NA = Not available

Of the twenty-seven radionuclides monitored, only nine were detected at measurable concentration in District's biosolids. Eight of these radionuclides are of natural origin and one, cesium-137, is a man-made radionuclide. The nine radionuclides detected in District biosolids were also reported in AMSA study, whereas eight radionuclides were reported in ISCORS survey. All the radionuclides in District's biosolids were within the minimum and maximum concentration range of ISCORS and AMSA reported results.

As with gross alpha and gross beta radioactivity, concentrations of gamma-emitting radionuclides were not directly determined in the biosolids that were applied to the Corn Fertility Plots used in this study, however the concentrations presented in Table 3 are thought to provide a good estimate of their concentrations in the land applied biosolids.

Gross Alpha and Beta Radioactivity in Soil, Corn Grain, and Corn Stover from Plots Receiving Continuous Long Term, High Rate Biosolids Applications

Radioactivity in biosolids-amended soil is a potential source of radiation to farmers, land application project workers, and land users such as recreators. It is also a potential source of contamination for food and forage. Radionuclides may accumulate in plants through uptake by roots from the soil. The District has measured the gross alpha and gross beta radioactivity concentration in soil, corn stover, and corn grain harvested from the Fulton County Corn Fertility Plots in 2000 and it is presented in Table 4. The data represents the mean of four sample-analyses for each treatment.

Table 4: Concentrations of Gross Alpha and Gross Beta Radioactivity in Soil, Corn Stover, and Corn Grain from Biosolids-Amended Mine Spoil.

	Gross Alpha Radioactivity ($Bq\ kg^{-1}$ DW)			Gross Beta Radioactivity ($Bq\ kg^{-1}$ DW)		
Treatment[a]	Soil	Stover	Grain	Soil	Stover	Grain
Control	340±64[b]	<7	<2	1,062±32	471±35	143±19
Quarter	293±38	18±7	<2	1,092±90	422±54	138±24
Half	318±42	15±3	<2	1,090±36	471±92	163±18
Maximum	352±75	<8	<2	1,066±22	505±89	144±32
ANOVA	NS	*	NS	NS	NS	NS

[a] Plots in the control treatment received 336-224-112 kg ha^{-1} of N-P-K annually, and plots in the quarter, half, and maximum treatments received 455, 909, and 1,817 Mg ha^{-1} of biosolids from 1973 through 2000 and 112 kg ha^{-1} K annually.

[b] Mean ± standard deviation.

* Significant at the 0.05 level of probability.

NS = Not significantly different.

The mean gross alpha radioactivity concentration in Stickney and Calumet WRP biosolids is 326 and 359 Bq kg^{-1} DW, respectively. These gross alpha radioactivity concentrations turn out to be very similar to the gross alpha radioactivity concentration in the soil from control plots which was 340 Bq kg^{-1} DW. This explains why there is no observed increase in gross alpha radioactivity with increased biosolids loading rate. The quarter maximum, half maximum, and maximum amended plots had mean soil gross alpha radioactivity concentrations of 293, 318, and 352 Bq kg^{-1} DW, respectively. There were no significant differences ($p<0.05$) among the soil gross alpha radioactivity concentrations for the four treatments. The District's biosolids are typical of what was found nationally with respect to gross alpha radioactivity concentration. Gross alpha radioactivity in biosolids was found to range from not detected to 5,069 Bq kg^{-1} DW with median 259 Bq kg^{-1} DW in the ISCORS survey (ISCORS 2003) and from not detected to 2,964 Bq kg^{-1} DW with median 274 Bq kg^{-1} DW in the AMSA survey (NBP 1999).

The mean gross beta radioactivity concentration in biosolids from the Stickney and Calumet WRPs is 918 and 855 Bq kg^{-1} DW, respectively. These gross beta radioactivity concentrations are slightly lower than the gross beta radioactivity concentration in soil from the control plots, which was 1,062 Bq kg^{-1} DW. As with gross alpha radioactivity, the gross beta radioactivity concentration in the biosolids and soil were very similar and there was no observed effect of increased biosolids loading rate on gross beta concentration in the soils from the treated plots. The mean gross beta radioactivity concentrations were 1,092, 1,090, and 1,066 Bq kg^{-1} DW soil for the quarter, half, and maximum biosolids-amended treatment plots, respectively. The mean gross beta radioactivity concentration in District biosolids is greater than the median concentrations observed in the AMSA survey (555 Bq kg^{-1} DW) and the ISCORS survey (481 Bq kg^{-1} DW) but far below the maximum concentrations observed in these surveys which were 2,278 and 3,441 Bq kg^{-1} DW, respectively.

The mean gross alpha radioactivity in corn stover harvested from the control plots was less than 7 Bq kg^{-1} DW, and in the quarter, half, and maximum treatment plots it was 18, 15, and less than 8 Bq kg^{-1} DW, respectively. The mean gross alpha radioactivity in the quarter and half maximum plots was significantly greater ($p<0.05$) than in the control, however it is difficult to attribute this difference to the biosolids treatments since the mean gross alpha concentration in the stover from the maximum amended plots was not significantly different from that of the control. The mean gross alpha radioactivity in corn grain was less than 2 Bq kg^{-1} DW in all the samples.

The mean gross beta radioactivity in corn stover harvested from the control plots was 471 Bq kg^{-1} DW, and in the quarter, half, and maximum treatment plots it was 422, 471, and 505 Bq kg^{-1} DW, respectively. There were no significant differences in these mean concentrations. The mean gross beta radioactivity in corn grain harvested from the control plots was 143 Bq kg^{-1} DW, and in the quarter, half, and maximum treatment plots it was 138, 163, and 144 Bq kg^{-1} DW, respectively. There were no significant differences in these mean concentrations.

The gross alpha radioactivity concentrations in soil and corn stover and grain did not reflect the different cumulative biosolids applications that were made to the quarter, half, and maximum treatment plots. The ANOVA's for gross alpha radioactivity concentrations in soil and corn grain (Table 4) show that there were no significant differences at 5% level between the biosolids-amended and control plots. The ANOVA's also show that the gross beta radioactivity concentrations in soil and corn stover and grain were not significantly different between the biosolids-amended and control plots (Table 4). This indicates that there was no increase in the uptake of gross beta radioactivity by corn grain from biosolids-amended soil.

Gamma-Emitting Radionuclide Concentrations in Soil, Corn Grain, and Corn Stover from Plots Receiving Continuous Long Term, High Rate Biosolids Applications

The mean concentrations of gamma-emitting radionuclides in biosolids-amended soil and corn stover and grain harvested from the Fulton County Corn Fertility Plots were also determined. The soils were analyzed for the same 27 radionuclides monitored in District biosolids and eight radionuclides were detected at measurable levels in the soil of the control and biosolids-amended plots as shown in Table 5. All of the nine radionuclides detected in District biosolids except Be-7 were also detected in soil from the Fulton County Corn Fertility Plots. Seven of the eight radionuclides that were detected in soil are of natural origin, and one, cesium-137, is a man-made radionuclide. Only potassium-40 was detected at measurable concentrations in stover, whereas only potassium-40 and radium-226 were detected at measurable levels in grain. The concentration of all other radionuclides monitored was below the detection limit. Comparison of mean concentrations of gamma-emitting radionuclides in District biosolids (Table 3) with concentrations in control soils (Table 5) indicates that there was little difference between their concentrations in biosolids and soil.

The data in Table 5 show that the concentrations of gamma-emitting radionuclides in soil from the control plots were similar to the radioactivity concentrations in biosolids-amended plots, except for potassium-40 and cesium-137 where significant differences were observed between the treatments. The mean potassium-40 concentration in the control plots was 634 Bq kg^{-1} DW, which is higher than the background potassium-40 concentration reported for soils at University of Illinois agricultural experiment station fields which ranged from 263 to 435 Bq kg^{-1} DW (Granato et al. 1994). The mean potassium-40 concentration in District biosolids is approximately half the concentration in the control plot soil, and this may have produced the significantly lower ($p<0.05$) concentration of potassium-40 that was observed in the soil of the maximum treatment plots which received 1,817 Mg ha^{-1} of biosolids at the time of this study.

Table 5: Concentrations of Gamma-Emitting Radionuclides in Soil and Corn Stover and Grain from Biosolids-Amended Mine Spoil.

Radionuclides	Treatment[a] Radioactivity (Bq kg^{-1} DW)				
	Control	Quarter	Half	Maximum	ANOVA
	---Soil---				
Potassium-40	634±36[b]	640±29	634±13	585±19	*
Radium-226	120±15	119±11	123±12	131±90	NS
Bismuth-212	27±4	27±4	26±0	24±2	NS
Lead-212	39±2	39±2	38±2	38±2	NS
Bismuth-214	40±4	41±4	40±2	39±2	NS
Lead-214	44±3	46±5	45±2	46±2	NS
Actinium-228	41±4	39±2	39±2	38±2	NS
Cesium-137	02±1	02±1	02±2	04±1	*
	---Corn Stover---				
Potassium-40	545±45	485±115	496±105	511±78	NS
Radium-226	ND[d]	ND	ND	ND	-
Bismuth-212	ND	ND	ND	ND	-
Lead-212	ND	ND	ND	ND	-
Bismuth-214	ND	ND	ND	ND	-
Lead-214	ND	ND	ND	ND	-
Actinium-228	ND	ND	ND	ND	-
Cesium-137	ND	ND	ND	ND	-
	---Corn Grain---				
Potassium-40	115±11	113±9	117±6	113±5	NS
Radium-226	24±2	028±2	023±2	027±2	*
Bismuth-212	ND	ND	ND	ND	-
Lead-212	ND	ND	ND	ND	-
Bismuth-214	ND	ND	ND	ND	-
Lead-214	ND	ND	ND	ND	-
Actinium-228	ND	ND	ND	ND	-
Cesium-137	ND	ND	ND	nd	-

[a] Plots in the control treatment received 336-224-112 N-P-K kg ha^{-1} annually, and plots in the quarter, half, and maximum treatments received 455, 909, and 1,817 Mg ha^{-1} of biosolids from 1973 through 2000 and 112 kg ha^{-1} K annually.

[b] Mean ± standard deviation.

* Significant at the 0.05 level of probability.

NS = Not significantly different.

ND = Not detected.

The cesium-137 concentration in the control plot soil was 2 Bq kg^{-1} DW, which is lower than most of the background concentrations observed at University of Illinois agricultural experiment station fields, which ranged from 1.67 Bq kg^{-1} DW at Dixon in 1955 to 12.0 Bq kg^{-1} DW at Hartsburg in 1965 (Granato et al. 1994). The mean cesium-137 concentration in District biosolids is higher than in the control plot soil (3 Bq kg^{-1} DW vs. 2 Bq kg^{-1} DW, respectively) which may explain why the mean soil cesium-137 concentration is significantly higher in the maximum treatment plots as compared to the other treatments. The mean concentrations of bismuth-212 and lead-212 in District biosolids are about half their concentrations in soil from the control plots (Tables 3 and 5). Like cesium-137 this resulted in the concentration of these radionuclides being lower in soil from maximum treated plots than in the control, however the differences were not significant.

The mean concentrations of actimium-228, bismuth-214, and lead-214 in District biosolids were very similar to those in the control plot soil (Tables 3 and 5). As a result, the mean soil concentrations of lead-214 and bismuth-214 fluctuated between the plots but did not differ significantly. Despite the similarity in mean concentration of actinium-228 in District biosolids and control plot soil, the mean soil concentration of actinium-228 decreased monotonically from the control to the maximum treated plots although the differences were not significant.

The mean radium-226 concentration in control plot soil was 120 Bq kg^{-1} DW, which is substantially lower than USEPA's CERCLA clean-up objective of 185 Bq kg^{-1} DW for surface soils (40 CFR Part 192 Subpart B). The mean concentration of radium-226 in District biosolids was slightly higher than the mean concentration in the control plot soils (Tables 3 and 5) which may explain why the mean concentration of radium-226 was higher in the soils of the half maximum and maximum amended plots than the control plots. This difference was not statistically significant ($p>0.05$) and the mean radium-226 concentration in the quarter maximum plots was less than the control indicating that the biosolids may not have been responsible for the observed pattern of radium-226 concentrations in these plots.

The concentrations of potassium-40 in the stover from biosolids-amended plots were not significantly different than the concentrations in stover from the control plots. In corn grain the concentrations of potassium-40 were not significantly different between the control and biosolids-amended plots. The ANOVA shows that the concentrations of radium-226 in corn grain varied significantly between the treatments (Table 5). The mean concentration of radium-226 in the grain from biosolids plots was similar to that observed in the control plots and although the mean radium-226 concentration was higher in grain from the maximum treated plots than in the control there was no monotonic trend of increasing grain radium-226 concentration with increasing biosolids loading rate.

Small amounts of bismuth-212, lead-212, bismuth-214, lead-214, actinium-228, and cesium-137 were found in soil from control and biosolids-amended plots, but these radionuclides were not detected in stover and grain from any of the plots. The data indicate that there was no uptake of gamma emitting radionuclides by corn stover and grain either from background soil pools or as a result of biosolids applications to land, even at cumulative biosolids loading rates of as high as 1,817 Mg ha^{-1}. The radiological analysis data show that long-term biosolids applications to the Fulton County Corn Fertility Plots on mine soil did not increase the radioactivity concentration in biosolids-amended soil or result in the uptake of radioactive materials by corn.

CONCLUSIONS

Long-term, high rate, biosolids applications to strip-mine soil did not significantly effect the concentrations of gross alpha or beta radioactivity and gamma-emitting radionuclides in the biosolids-amended soil or in corn tissues. Potassium-40, a beta emitter, was the only radionuclide detected in both corn stover and grain. Gross beta radioactivity was also detected in both stover and grain. Gross alpha radioactivity was only detected in corn stover, and radium-226 was detected only in grain. As expected, the concentrations of potassium-40 were lower in corn grain as compared to soil and corn stover. Since there were no significant differences in the concentrations of potassium-40 in corn tissues from the control and biosolids-amended soils, the radium-226 concentrations in corn grain from the biosolids plots were similar to those in the control plots, and no other radionuclides were even detected in corn tissues in this study. It is concluded that long-term, high rate, biosolids applications to strip-mine soil at the District's Fulton County site has had minimal impact on soil and corn crop quality and does not appear to increase risk of exposure to radioactive materials significantly above background for the site.

ACKNOWLEDGEMENTS

The authors wish to acknowledge Mr. Bernard Sawyer for reviewing this report, the staff of the Fulton County Land Reclamation Laboratory Section for sample collection and Harold Robinson for sample preparation. Dr. Zainul Abedin conducted the statistical analyses. Special thanks are due to Nancy Urlacher for typing this report.

DISCLAIMER

Mention of proprietary equipment and chemicals in this report does not constitute endorsement by the Metropolitan Water Reclamation District of Greater Chicago

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THE VILLAGE OF
BARTLETT

228 S. MAIN STREET
BARTLETT, ILLINOIS 60103
PHONE 630.837.0800
FAX 630.837.7168

October 26, 2010

Attached are itemized, monthly lease amounts paid by the Village of Bartlett, Illinois to Water Remediation Technologies, LL for the lease of radium removal equipment at two of the Village's wells. Equipment is planned for installation at two additional wells in town which will in effect double the amount already shown on these two documents.

Additionally in the packet is a spreadsheet showing the test results of the radium content in Bartlett's sludge. As is shown, even though a radium removal system is installed on the potable water system, radium is still present in the wastewater treatment plant sludge. Further fees or additional sludge hauling costs due to the radium, would put additional financial stress on the people of the Village of Bartlett.

THE VILLAGE OF BARTLETT PROGRESS WITH PRIDE

Ronald Johnson

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Village of Bartlett
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Bartlett, IL 60103-8807

Phone: 630-837-0811
FAX: 630-837-9043

Village of Bartlett

Well No. 4 Radium Removal by Water Remediation Tech., LL

INVOICE DATE	INVOICE NUMBER	PAYMENT DESCRIPTION	AMOUNT
6/30/2006	000167	Base Treatment Charge	$9,086.03
10/1/2006	000409	Base Treatment Charge	$9,086.03
11/1/2006	000494	Base Treatment Charge	$9,086.03
12/1/2006	000699	Base Treatment Charge	$9,086.03
1/15/2007	000752	Base Treatment Charge	$9,351.42
2/5/2007	000773	Base Treatment Charge	$9,351.42
3/1/2007	000796	Base Treatment Charge	$9,351.42
4/2/2007	000872	Base Treatment Charge	$9,351.42
5/1/2007	000914	Base Treatment Charge	$9,351.42
6/1/2007	000973	Base Treatment Charge	$9,351.42
7/2/2007	001007	Base Treatment Charge	$9,351.42
8/1/2007	001053	Base Treatment Charge	$9,351.42
9/4/2007	001124	Base Treatment Charge	$9,351.42
10/1/2007	001184	Base Treatment Charge	$9,351.42
11/1/2007	001232	Base Treatment Charge	$9,351.42
12/3/2007	001302	Base Treatment Charge	$9,351.42
1/2/2008	001376	Base Treatment Charge	$9,648.50
2/1/2008	001454	Base Treatment Charge	$9,648.50
3/3/2008	001506	Base Treatment Charge	$9,648.50
4/1/2008	001564	Base Treatment Charge	$9,648.50
5/1/2008	001628	Base Treatment Charge	$9,648.50
6/1/2008	001682	Base Treatment Charge	$9,648.50
7/1/2008	001743	Base Treatment Charge	$9,648.50
8/1/2008	001804	Base Treatment Charge	$9,648.50
9/1/2008	001863	Base Treatment Charge	$9,648.50
10/1/2008	001930	Base Treatment Charge	$9,648.50
11/1/2008	002014	Base Treatment Charge	$9,648.50
12/1/2008	002086	Base Treatment Charge	$9,648.50
12/12/2008	002138	Chemical Feed System	$575.00
1/1/2009	002160	Base Treatment Charge	$9,707.92
2/1/2009	002246	Base Treatment Charge	$9,707.92

Village of Bartlett
Well No. 4 Radium Removal by Water Remediation Tech., LL

INVOICE DATE	INVOICE NUMBER	PAYMENT DESCRIPTION	AMOUNT
2/1/2009	002246	Chemical Feed System	$575.00
3/2/2009	002350	Base Treatment Charge	$9,707.92
3/2/2009	002350	Chemical Feed System	$575.00
3/23/2009	002373	Media Exchange	$69,465.00
3/23/2009	002371	Chemical Feed System	$8,945.00
4/1/2009	002392	Base Treatment Charge	$9,707.92
4/1/2009	002392	Chemical Feed System	$575.00
5/1/2009	002455	Base Treatment Charge	$9,707.92
5/1/2009	002455	Chemical Feed System	$575.00
6/1/2009	002522	Base Treatment Charge	$9,707.92
6/1/2009	002522	Chemical Feed System	$575.00
7/1/2009	002584	Base Treatment Charge	$9,707.92
7/1/2009	002584	Chemical Feed System	$575.00
8/1/2009	002645	Base Treatment Charge	$9,707.92
8/1/2009	002645	Chemical Feed System	$575.00
9/1/2009	002719	Base Treatment Charge	$9,707.92
9/1/2009	002719	Chemical Feed System	$575.00
10/1/2009	002784	Base Treatment Charge	$9,707.92
10/1/2009	002784	Chemical Feed System	$575.00
11/1/2009	002851	Base Treatment Charge	$9,707.92
11/1/2009	002851	Chemical Feed System	$575.00
12/1/2009	002932	Base Treatment Charge	$9,707.92
12/1/2009	002932	Chemical Feed System	$575.00
12/14/2009	003008	License Fee	$1,478.50
1/1/2010	003044	Base Treatment Charge	$9,826.75
1/1/2010	003044	Chemical Feed System	$575.00
2/1/2010	003140	Base Treatment Charge	$9,826.75
2/1/2010	003140	Chemical Feed System	$575.00
3/1/2010	003210	Base Treatment Charge	$9,826.75
3/1/2010	003210	Chemical Feed System	$575.00
4/1/2010	003285	Base Treatment Charge	$9,826.75
4/1/2010	003285	Chemical Feed System	$575.00

Village of Bartlett
Well No. 4 Radium Removal by Water Remediation Tech., LL

INVOICE DATE	INVOICE NUMBER	PAYMENT DESCRIPTION	AMOUNT
5/1/2010	003364	Base Treatment Charge	$9,826.75
5/1/2010	003364	Chemical Feed System	$575.00
6/1/2010	003443	Base Treatment Charge	$9,826.75
7/1/2010	003529	Base Treatment Charge	$9,826.75
8/1/2010	003612	Base Treatment Charge	$9,826.75
8/2/2010	003669	Liscense Fee	$428.00
8/2/2010	003669	Waste Compact Fee	$4,320.00
9/1/2010	003730	Base Treatment Charge	$9,826.75
		TOTAL	**$563,690.45**

Village of Bartlett

Well No. 7 Radium Removal by Water Remediation Tech., LL

INVOICE DATE	INVOICE NUMBER	PAYMENT DESCRIPTION	AMOUNT
3/1/2007	000797	Base Treatment Charge	$6,167.92
3/2/2007	000793	Base Treatment Charge	$3,083.96
4/2/2007	000873	Base Treatment Charge	$6,167.92
5/1/2007	000915	Base Treatment Charge	$6,167.92
6/1/2007	000974	Base Treatment Charge	$6,167.92
7/2/2007	001008	Base Treatment Charge	$6,167.92
8/1/2007	001054	Base Treatment Charge	$6,167.92
9/4/2007	001125	Base Treatment Charge	$6,167.92
10/1/2007	001185	Base Treatment Charge	$6,167.92
11/1/2007	001233	Base Treatment Charge	$6,167.92
12/3/2007	001303	Base Treatment Charge	$6,167.92
1/2/2008	001377	Base Treatment Charge	$6,345.65
2/1/2008	001455	Base Treatment Charge	$6,345.65
3/3/2008	001507	Base Treatment Charge	$6,345.65
4/1/2008	001565	Base Treatment Charge	$6,345.65
5/1/2008	001629	Base Treatment Charge	$6,345.65
6/1/2008	001683	Base Treatment Charge	$6,345.65
7/1/2008	001744	Base Treatment Charge	$6,345.65
8/1/2008	001805	Base Treatment Charge	$6,345.65
9/1/2008	001864	Base Treatment Charge	$6,345.65
10/1/2008	001931	Base Treatment Charge	$6,345.65
11/1/2008	002015	Base Treatment Charge	$6,345.65
12/1/2008	002087	Base Treatment Charge	$6,345.65
12/12/2008	002136	Increase in Base Treatment Fee	$2,254.35
12/12/2008	002137	Chemical Feed System	$344.00
1/1/2009	002197	Base Treatment Charge	$8,663.06
1/23/2009	002228	Mobilization - Pilot Equipment	$2,500.00
1/23/2009	002229	Mixer for Chemical Feed System	$708.96
2/1/2009	002247	Base Treatment Charge	$8,663.06
2/1/2009	002247	Chemical Feed System	$344.00
3/2/2009	002351	Base Treatment Charge	$8,663.06
3/2/2009	002351	Chemical Feed System	$344.00

Village of Bartlett

Well No. 7 Radium Removal by Water Remediation Tech., LL

INVOICE DATE	INVOICE NUMBER	PAYMENT DESCRIPTION	AMOUNT
4/1/2009	002393	Base Treatment Charge	$8,663.06
4/1/2009	002393	Chemical Feed System	$344.00
5/1/2009	002456	Base Treatment Charge	$8,663.06
5/1/2009	002456	Chemical Feed System	$344.00
6/1/2009	002523	Base Treatment Charge	$8,663.06
6/1/2009	002523	Chemical Feed System	$344.00
7/1/2009	002585	Base Treatment Charge	$8,663.06
7/1/2009	002585	Chemical Feed System	$344.00
8/1/2009	002646	Base Treatment Charge	$8,663.06
8/1/2009	002646	Chemical Feed System	$344.00
9/1/2009	002720	Base Treatment Charge	$8,663.06
9/1/2009	002720	Chemical Feed System	$344.00
9/28/2009	002773	Pilot Study	$3,700.00
10/1/2009	002785	Base Treatment Charge	$8,663.06
10/1/2009	002785	Chemical Feed System	$344.00
11/1/2009	002852	Base Treatment Charge	$8,663.06
11/1/2009	002852	Chemical Feed System	$344.00
12/1/2009	002933	Base Treatment Charge	$8,663.06
12/1/2009	002933	Chemical Feed System	$344.00
12/14/2009	003009	License Fee	$1,478.50
1/1/2010	003045	Base Treatment Charge	$8,789.20
1/1/2010	003045	Chemical Feed System	$344.00
2/1/2010	003141	Base Treatment Charge	$8,789.20
2/1/2010	003141	Chemical Feed System	$344.00
2/26/2010	003200	Issuance of PO - Commence Work	$32,790.00
3/1/2010	003211	Base Treatment Charge	$8,789.20
3/1/2010	003211	Chemical Feed System	$344.00
3/23/2010	003273	Release for Fabrication	$54,650.00
4/1/2010	003286	Base Treatment Charge	$8,789.20
4/1/2010	003286	Chemical Feed System	$344.00
5/1/2010	003365	Base Treatment Charge	$8,789.20
5/1/2010	003365	Chemical Feed System	$344.00

Village of Bartlett

Well No. 7 Radium Removal by Water Remediation Tech., LL

INVOICE DATE	INVOICE NUMBER	PAYMENT DESCRIPTION	AMOUNT
5/17/2010	003421	Media Exchange Charge	$142,618.00
6/1/2010	003444	Base Treatment Charge	$2,293.33
6/11/2010	003498	Modifications Complete	$76,510.00
7/1/2010	003530	Base Treatment Charge	$2,293.33
7/26/2010	003601	System Functioning	$54,650.00
8/1/2010	003613	Base Treatment Charge	$2,293.33
8/2/2010	003670	License Fee	$428.00
8/2/2010	003670	Waste Compact Fee	$2,952.00
9/1/2010	003731	Base Treatment Charge	$2,293.33
		TOTAL	**$679,074.81**

RADIUM TEST RESULTS
VILLAGE OF BARTLETT SLUDGE
pCi/g

	Ra-226	+/-	Ra-228	+/-
Apr-04	**1.7**	0.1	**2.5**	0.2
Nov-04	**3.4**	0.2	**4.7**	0.3
Apr-05	**2.2**	0.1	**2.6**	0.1
Sep-05	**4.0**	0.1	**4.4**	0.2
Mar-06	**<1.5**		**<1.5**	
Oct-06	**0.2**	0.06	**1.4**	0.8
Oct-07	**0.3**	0.09	**0.4**	0.9
Nov-07	**0.5**	0.1	**2.0**	1.5
Mar-08	**0.5**	0.06	**0.1**	0.2
Oct-08	**3.4**	0.1	**4.1**	0.2
Mar-09	**3.4**	0.1	**3.4**	0.2
Oct-09	**4.0**	0.1	**4.7**	0.3
Mar-10	**2.8**	0.1	**2.8**	0.2

Reported together as one

Testimony before the Illinois Emergency Management Agency
Wednesday, October 27, 2010
Re: Licensing of Radioactive Materials, 33 Ill. Reg. 12061, Proposed Rulemaking

My name is Mark Eddington and I am here today on behalf of the DeKalb Sanitary District (District). The District is located at 303 Hollister Drive, in the City of DeKalb. I am licensed engineer in the State of Illinois and Wisconsin and am employed by the District as its manager.

The District is located in north central Illinois and is the Designated Management Agency responsible for wastewater collection, treatment, and planning for a 34 square mile area that includes the City of DeKalb (City), Northern Illinois University, and other unincorporated properties. The District receives an average daily flow of about 7 million gallons of wastewater that is treated and discharged to the North Branch of the Kishwaukee River. Presently, the treatment plant solids are treated with anaerobic digestion and land applied. The District is currently under construction with improvements that include a biosolids dewatering facility utilizing gravity belt thickeners and centrifuges for drying. The dewatered biosolids will be stored in the District's storage facility until they can be land applied on local agricultural fields.

In addition to serving nearly 10,800 residential and industrial accounts, the District receives the backwash water from five of the City's water treatment plants. The City's deionization plants treat the raw deep well water, and its filters discharge backwash water to the District's collection system. The District has been receiving the treated backwash water from the City's water treatment plants since 2001.

The District's philosophy towards more stringent limits of contaminants, on every occasion experienced, has been steered by science. To date, I am unaware of any definitive scientific evidence put forth by IEMA to support the current limit of 0.4 pCi/gram. From our perspective, the most troubling facet of this rule making process has been the perceived arbitrary nature by which IEMA has promulgated the 0.4 pCi/gram limit. The City of Joliet commissioned a study by a well respected physicist, Dr. Mossman, which concluded that higher limits are protective of the public health. The IEMA's limit of 0.4 pCi/gram is not as low as reasonably achievable (ALARA) and does not meet this important radiation industry standard. The aforementioned study determined that the costs to meet this lower standard would be between 11 and 400 times more than the economic benefit to society. ALARA projects do not have costs more than 10 times the societal benefits. In any event, this proposed rule change could render land application of sludge an unsustainable approach for the disposal of biosolids. Without the ability to cost effectively land apply biosolids, DeKalb's citizens ~~would~~ could M.E. be ultimately responsible for the higher costs involved in utilizing low level nuclear disposal sites. This is a high cost to pay for little to no societal benefit.

The DeKalb Sanitary District feels that this rulemaking process should continue involving all the stakeholders and should be steered by science. Thank you for the opportunity to speak today.

City of
KEWANEE
A City of Choice
Illinois

MAYOR'S OFFICE
401 E. THIRD STREET
KEWANEE, IL 61443-2365
VOICE 309-852-5044 FAX 309-854-5329

October 27, 2010

Illinois Emergency Management Agency
Ms. Louise Michaels
1035 Outer Park Drive
Springfield, IL 62704

RE: Written comments for IEMA public hearing on Licensing of Radioactive Material, 32 Ill. Adm. Code 330.40, 33 Ill. Reg. 12061; August 28, 2009.

Dear Ms. Michaels,

On behalf of the citizens of Kewanee, I thank Illinois Emergency Management Agency for listening to our concerns in this matter. I am aware IEMA has the very difficult task of balancing protection of public health with ability for humans to continue to reside in, and make productive use of their land, in their communities. It is encouraging to see IEMA proceed with all due deliberation on this matter.

The City of Kewanee is not advocating any regulations be implemented that the data shows are reasonably certain to cause health concerns. Rather, the City of Kewanee is advocating to have the regulations regarding radium content in land-applied sludge set at a level which the data shows is reasonably certain to not cause health concerns.

Kewanee does not have the technical expertise, or the financial resources to allow an independent study of the public health aspects of this discussion. Kewanee will rely on the facts and fact-based conclusions that are formulated by the experts assembled by others to discuss that vital topic. At the layman's level of interpretation of the data, it appears there is a considerable weight of evidence present to show the proposed 1.0 picoCurrie per gram increase in combined radium meets the criteria of being a level at which it is reasonably certain there will be no health concerns.

In a rural setting such as Kewanee, as is the case with most of the areas in northern Illinois with radium concerns, cropland application of sludge from the sewer treatment plant is the least costly method of sludge disposal. The 2004 study done for the City of Joliet by Clark Dietz, Inc. of Champaign, Illinois did a good job of quantifying those costs. Costs in Kewanee are proportional, trending just a bit higher per unit due to economies of scale in the larger community.

Kewanee sludge combined radium content for last three years averaged 33 picoCurries per gram. For the same period of time the dry ton application rate was approximately 4 tons per acre. With the 1.0 standard, Kewanee could expect to get 14 applications to a given site. With the 0.4 standard, Kewanee could expect to get 5 applications to any given site. Were available land unlimited, and if transportation expenses were fixed, the reduced number of applications would not be a concern.

But, the reality is that reducing applications per field accelerates spending. Capital outlays increase for land acquistion. Annual expenses increase for hauling sludge to more remote areas. All of those economic forces accelerate the rate of spending for sludge disposal. Ultimately, this will lead to landfilling of the sludge as the most economical method of disposal. As shown in the 2004 Clark-Diest study for Joliet, by that time one is paying four to five times more annually for sludge disposal. For Kewanee, perhaps $120,000 to $150,000 annually versus current estimate of $30,000 annually.

Were there indisuputable evidence showing the harm of the 1.0 standard, the City of Kewanee would not be providing this input. However, the evidence available to the City provides every indication that the 1.0 standard does provide a reasonable level of protection to the public health. I again encourage IEMA to remain mindful of balancing protecting the health of persons in the area with the ability of persons to afford to continue living in the area.

Thank you for your time and consideration.

Sincerely,

Bruce Tossell

Bruce Tossell
Mayor of Kewanee